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MONTHLY NOTICES

OF THE

ROYAL ASTRONOMICAL SOCIETY.

VOL. LIII. NO. 5. MARCH 1893.

Fellows of the Society are informed that post-cards containing the titles of papers to be read at the evening meetings will be sent to those who shall express their wish to receive them. Fellows desiring to receive the post-cards are requested to send their names to the Assistant-Secretary, Mr. W. H. Wesley, Burlington House, London, W.

In order to enable the Secretaries to prepare complete lists in time for the issue of the post-cards, authors are particularly requested to send in their papers not later than the Tuesday preceding the day of meeting.

MONTHLY NOTICES

OF THE

ROYAL ASTRONOMICAL SOCIETY.

VOL. LIII. MARCH 10, 1893. No. 5

Captain W. DE W. ABNEY, C.B., R.E., D.C.L., F.R.S., President, in the Chair.

Maurice Anderson Ainslie, B.A., Giggleswick School, near Settle, Yorkshire;
James Arthur Formoy, F.C.S., Lestelle, London Road, Forest Hill, S.E.;
Henry Bateman Massey, Spalding, Lincolnshire;
John Mills, 11 Henrietta Street, Covent Garden, W.C., and 44 Orbel Street, Battersea Park, S.W.; and
Edward Turner Whitelow, 70 Deansgate, Manchester,

were balloted for and duly elected Fellows of the Society.

The following candidates were proposed for election as Fellows of the Society, the names of the proposers, from personal knowledge, being appended:—

Walter Frederick Gale, M.R.S. of N.S.W., The Observatory, Paddington, New South Wales, Australia (proposed by H. C. Russell);
The Rev. P. H. Kempthorne, M.A., late Fellow of St. John's College, Cambridge, Tutor and Assistant Master at Wellington College, Berks (proposed by Sir R. S. Ball);
James Henry Young, B.Sc. Lond., H.M. Office of Works, The Dell, Tooting Graveney, Surrey (proposed by Robert Bryant).

One hundred and sixteen presents were announced as having been received since the last meeting, including, amongst others:—

Transactions of the Yale University Observatory, vol. i. parts 3 and 4, presented by the Observatory; Harvard College Observatory Annals, vol. xv. part 2, catalogue of 8,627 stars, presented by the Observatory; R. A. Proctor and A. Cowper Ranyard, Old and New Astronomy, presented by Mr. Ranyard; J. de Mendizábal Tamborrel, Tables de Logarithmes, presented by the author; Amy Johnson, Sunshine, presented by the author; Karlsruhe Observatory, Veröffentlichungen, Heft IV., presented by the Observatory; Photographs of the Milky Way, minor planets, meteor tracks, &c., presented by Dr. Max Wolf, per Mr. A. Taylor; Positive enlargements of photographs of *Jupiter* made at the Lick Observatory, presented by the Observatory; Further portion of a series of photographs of the Presidents of the Society, presented by Mr. W. Schooling; Enlargements from a series of negatives of the region surrounding η *Argûs*, and other astronomical photographs made at the Cape Observatory, presented by Dr. Gill.

Photographs of past Presidents of the Society.

It has already been announced that Mr. Schooling is presenting to the Society a series of beautiful photographs of the past presidents, and two instalments have been warmly acknowledged at evening meetings. To complete the series Mr. Schooling would be glad of the loan of portraits of the following:—

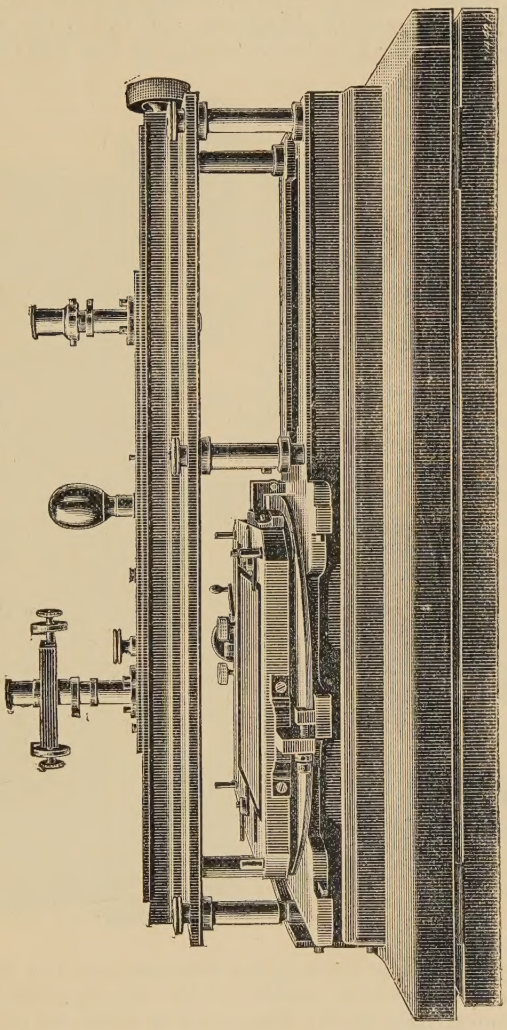
H. T. Colebrooke (1823–24),
Bishop Brinkley (1831–32),
Manuel J. Johnson (1855–56),
Warren De la Rue (1864–65),

and any information which might help him to this end will be gratefully received either by him or by the secretaries.

A Micrometer for measuring the Plates of the Astrophotographic Chart. By W. H. M. Christie, M.A., F.R.S., Astronomer Royal.

For the measurement of the catalogue plates of the Astrophotographic Chart, the micrometric slide originally made by Messrs. Troughton & Simms for the measurement of the distance of *Venus* from the Sun's centre on the transit of *Venus* photographs, 1874, by the help of an auxiliary millimetre scale on plate-glass, has been adapted to the ready determination of rectangular coordinates and diameters of disks of stars on $16^{cm} \times 16^{cm}$ plates.

The two figures will give an idea of the general arrangement. Two microscopes, rigidly connected, are mounted in a longitudinal hollow frame or slide, which can be moved quickly by hand to any position in a long slide, and clamped securely.



Micrometer for Stellar Photographs, Royal Observatory, Greenwich.

Fig. 1.—View nearly in plane of photograph.

A slow motion can be given to this latter and to the frame carrying the two microscopes by means of a screw, shown on the right. The photographic plate (in a suitable frame) is viewed by the left-hand microscope (which is provided with a parallel-

wire micrometer, to be described presently), and a glass scale, divided into millimetres, is viewed by the other. The plate is held in its frame, with film uppermost, in precisely the same manner as in the plateholder at the breech end of the photo-telescope, being pressed laterally by springs against two studs on one side (for orientation), and against one stud in the middle of the adjacent side (for fixity of position), the film side being kept

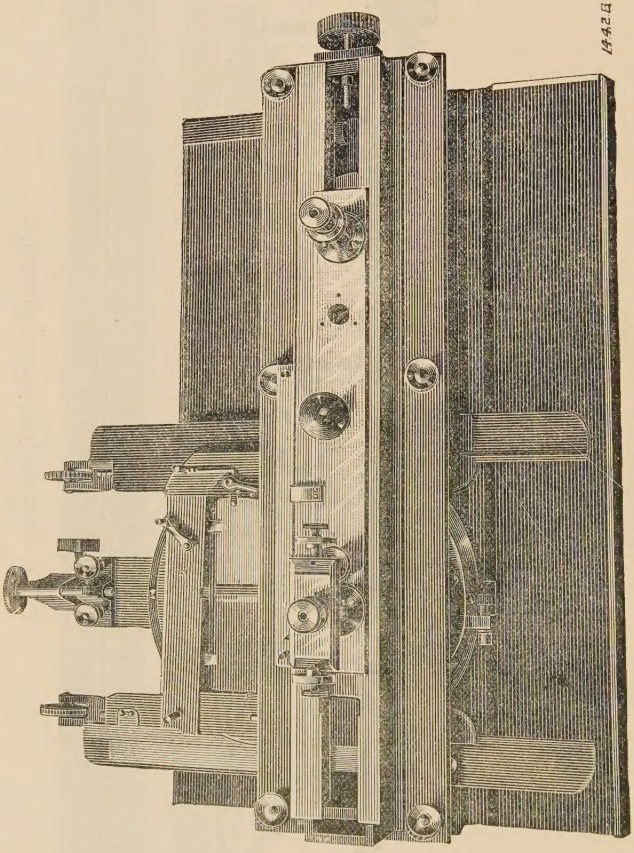


FIG. 2.—View from above.

in bearing with three studs in the focal plane of the microscope (at two corners and the middle of the side opposite) by three springs immediately below. The frame in which the plate is held is capable of rotation through 90°, banking against adjustable screws so that the cross lines of the réseau can be successively placed parallel to the micrometer slide and coordinates measured in the two directions at right angles. It is, further, mounted in a slide perpendicular to the micrometer slide (with adjustment

for accurate perpendicularity), so that by the longitudinal motion of the microscope and the transverse motion of the photograph, any point of the latter can be brought under the microscope, the approximate coordinates being read off by millimetre scales attached to the two slides. The whole instrument is mounted on a hinged wooden frame, so that the plane of the photograph can be tilted to any convenient angle for vision by transmitted light from a reflector or white paper below, the plate and frame being counterpoised by two weights running over pulleys at the top of the transverse slide.

The star to be measured having been brought near the centre of the field of the left-hand microscope by the quick motion, the microscope frame is clamped, and, by means of the slow motion, the corresponding division of the millimetre scale is bisected by the fixed parallel wires of the right-hand microscope. The star is then measured with the left-hand micrometer-microscope. This is arranged to give readily the reading for the centre of the star's disk and its diameter, the principle being that devised by Sir G. B. Airy for the Reflex Zenith Tube at Greenwich. There are two micrometers, A carrying its own wire and also the bearing of B, which carries a parallel wire. The screws for A and B have the same pitch, representing 20″ or $\frac{1}{3}$mm on the plate, and the heads are divided (in opposite directions) into 100 parts, so that in the sum of two readings 1 div.=0″·1. (It is intended that two readings should be taken as a rule.) It will be seen that if a and b are the readings of the two micrometers when their wires (crossed relatively to their respective heads) are placed on the two edges of the star's disk, its diameter would be b (the zero of micrometer B being adjusted for coincidence of its wire with that of A), and the reading for its centre would be $a+\frac{1}{2}b$. One coordinate having thus been measured, the plate is rotated through 90°, and the other is similarly obtained, while the photographic magnitude is inferred from the measures of diameters (by microscope B).

By this arrangement it will be seen that the positions of stars can be expeditiously found without the necessity for measurement of the lines of the réseau, and thus great labour may be saved.

Royal Observatory, Greenwich :
1893 *March* 8.

Historical Note on the Parallel Plate Double-Image Micrometer.

By J. H. Poynting.

(*Communicated by Sir R. S. Ball.*)

A description of a parallel plate double-image micrometer which I designed last year, under the belief that it was new, appeared in the *Monthly Notices*, vol. lii. No. 8, p. 556.

I have just found from the article "Micrometer" in the *Encyclopædia Britannica* that the device is more than fifty years old, having been invented by Clausen in 1841 for apparently the first time. I have not access to his description, which is given in *Ast. Nach.* xviii. 1841, col. 95–96.

In the following year the micrometer was re-invented by Porro (*C.R.* vol. xli. 1855, p. 1058). Porro used both the double-image form for the telescope and the single-image form for the microscope, with the parallel plate between stage and objective. He saw the advantage which the instrument possesses, in that it can be placed on an independent support. He was evidently convinced of the great value of the parallel plate for micrometry, and appears to have made considerable use of it. Secchi (*C.R.* vol. xli. 1855, p. 906) tried the micrometer, which he ascribed to Porro. He found it likely to be serviceable, but had not time to develope it.

Helmholtz appears to have been the third inventor of the instrument. He used it in his ophthalmometer, which is simply a short-range telescope with two parallel plates in front of the object-glass rotating in opposite directions about an axis, through equal angles. Each plate covers one half of the object-glass, and so rotation produces a double image. (*Physiol. Optik.* ed. 1867, p. 8.)

My own design appears, therefore, to stand at least fourth on the list, and I am exceedingly sorry to have troubled the Society with an account of a device as a novelty when it turns out to be so old. But though old, it is not, I am convinced, well known.

Now that I have no claim to its invention, I may perhaps fairly express the opinion that the instrument is of great value. I have used it a good deal in the single-plate form in front of the objectives of cathetometer telescopes and microscopes, and find it accurate and easy to use. It has the further merit that it is very cheap. If once introduced into laboratories I am sure that it would be found applicable—with good results—for many purposes. Should this note and its predecessor aid in such introduction, there will be some excuse for the re-invention of the instrument.

Photograph of the Nebula M. 77 Ceti. By Isaac Roberts, D.Sc., F.R.S.

The photograph was taken on 1892 November 26. Exposure 90 minutes. R.A. $2^h\ 37^m$. Decl. 0° 27′ south.

The nebula is described by Sir John Herschel as very bright, pretty large, irregularly round, suddenly much brighter in the middle, with a nucleus partially resolved. A drawing of it is given in the *Phil. Trans.* for 1861, Pl. XXV., fig. 4.

Mr. Lassell, in the *Memoirs of the Royal Astronomical Society*, vol. xxxvi., Pl. I., fig. 2, p. 40, describes the nebula, and, by a drawing, shows it to be spiral, accompanied by a near nebulous star.

Lord Rosse, in the *Observations of Nebulæ and Clusters of Stars*, p. 32, Pl. I., records twelve observations of the nebula, made between the years 1848 and 1874. The nebula is described as a spiral, with bright patches involved.

None of the drawings referred to do more than indicate some of the prominent features of the nebula, but the photograph reveals, in considerable detail, the structure and distribution of the nebulosity.

The nucleus is stellar, with projecting ansæ of dense nebulosity on the north following and south preceding sides; and surrounding this dense composite nucleus is a zone of faint nebulosity, bounded by a broad nebulous ring, which is studded with strong condensations resembling stars with irregular margins. Six or eight of the nebulous patches can, on the negative, be discerned; and if we wished to point out the formation of a stellar system, now in visible process of condensation from a nebula, this object would supply the evidence necessary in a very forcible manner to the eye.

The star to which Lassell referred is not shown to be nebulous, but is as sharply defined as any of the other stars on the plate.

An enlarged photograph from the negative is now presented, and also one shown projected on the screen.

Photograph of the Cluster M. 103 Cassiopeiæ. By Isaac Roberts, D.Sc., F.R.S.

The photograph of the cluster M. 103 Cassiopeiæ, R.A. $1^h\ 26^m$, Decl. north 60° 9′, was taken on 1892 December 23, with an exposure of 60 minutes, and the enlargement of it now presented is to the scale of 24 seconds of arc to one millimetre.

The cluster is No. 341 in the *General Catalogue* and is described by Sir J. Herschel as "bright; round; rich; pretty large; stars 10 to 11th magnitude."

The photograph shows the stars from 8th to 15th mag., and several of them have what appear to be *comites*, at a few seconds of arc distance; but this characteristic is not more remarkable in this cluster and its surroundings than it is on many other photographs which I have taken in different regions of the sky. The cluster is not strikingly round or symmetrical, nor are the stars very close together, and it is entirely free from nebulosity.

About 40 minutes of arc from the cluster, in the north following quadrant (R.A. $1^h\ 28^m$, Decl. N. 60° 48′), is a very remarkable group of stars arranged in two parallel straight lines of four each. The stars are all of about 10th mag., and the photo-disks partly overlap each other, so that the combination appears like a star trail; and, in order to make sure that it was not a trail, a second photograph was taken with a short exposure. The group is surrounded by stars of 10th to 14th mag.

Comet Holmes. By Isaac Roberts, D.Sc., F.R.S.

In the *Edinburgh Circular*, No. 37, 1893 January 17, it was announced that Professor Palisa, of Vienna, saw Comet Holmes as an 8th-magnitude fixed star with a nebulous envelope 20 seconds of arc in diameter, and Dr. Huggins had, a day or two previously, called my attention to the announcement.

A photograph of the comet was taken with the 20-inch reflector on January 18, and exposure of 30 minutes, upon which it appeared as a very dense circular nucleus surrounded by symmetrical nebulosity, which gave the comet the appearance of a nebulous star. The extreme diameter of the nebulosity measured 39 seconds of arc, and the diameter of the nucleus measured 14 seconds. The nucleus and the nebulosity had not well-defined boundaries, but one shaded into the other imperceptibly.

On January 20 another photograph was taken with an exposure of 50 minutes, and on this also the comet appears like a large nebulous star, the extreme diameter of which measured 145 seconds of arc, and the diameter of the nucleus 53 seconds. The nucleus and the nebulosity surrounding it are very dense and symmetrically circular, without sharply defined boundaries.

On January 27 another photograph was taken, with exposure of 15 minutes, upon which the comet appears with a faint nucleus, a faint tail, and very faint nebulosity surrounding them, much like the form shown on the photograph presented to the Society at the meeting in December last.

On February 4 another photograph was taken, with exposure of 52 minutes, and the appearance of the comet very strongly resembled that referred to in the foregoing paragraph—it had a nucleus, a tail, and faint nebulosity surrounding them; much like those shown on the photograph presented in December.

The negatives do not indicate any stars or nebulæ on the orbital course of the comet that might temporarily add to its brightness when in transit over them, but whatever the cause may have been, the reality of the phenomena can scarcely be doubted, for both eye-observations and the photographs confirm each other.

On the Orbit of Σ 1785. By J. E. Gore.

Using the measures of this binary pair given by Mr. Burnham in the *Monthly Notices* for 1892 December, I have computed the orbit, and find the following provisional elements —

Elements of Σ 1785.

P = 125·52 years	Ω = 137° 1′
T = 1904·84	λ = 220° 21′
e = 0·6377	a = 2″·18
i = 34° 46′	μ = +2°·868

The following is a comparison between the measures and the positions computed from the above elements :—

Epoch.	Observer.	θ_o	θ_c	$\theta_o-\theta_c$	ρ_o	ρ_c	$\rho_o-\rho_c$
		°	°	°	″	″	″
1823·40	South	160·4	157·3	+3·1	5·66	3·25	(+2·41)
1830·12	Struve	164·4	162·7	+1·7	3·49	3·33	+0·16
1830·20	Herschel	164·5	162·8	+1·7	4·62	3·33	(+1·29)
1831·34	Herschel	166·3	163·6	+2·7	(7·69)	3·38	(+4·31)
1843·48	Mädler	174·6	173·0	+1·6	3·39	3·30	+0·09
1846·40	Philpott	176·2	175·3	+0·9	3·19	3·26	−0·07
1850·44	Mädler	178·0	178·7	−0·7	...	3·18	...
1851·28	Mädler	178·7	179·4	−0·7	3·48	3·16	+0·32
1855·32	Mädler	183·6	182·9	+0·7	3·11	3·08	+0·03
1856·31	Mädler	183·1	184·0	−0·9	2·97	3·05	−0·08
1856·36	Secchi	186·0	184·0	+2·0	3·24	3·05	+0·19
1858·38	Dembowski	185·1	185·8	−0·7	3·12	3·05	+0·12
1859·32	Morton	185·4	186·7	−1·3	2·89	2·97	−0·08
1861·57	Mädler	190·0	188·9	+1·1	3·51	2·90	+0·61
1863·31	Radcliffe	192·0	190·7	+1·3	2·73	2·83	−0·10
1863·68	Dembowski	191·1	191·1	0·0	2·66	2·82	−0·16
1864·47	Engelmann	193·5	192·0	+1·5	2·88	2·80	+0·08
1865·42	Engelmann	193·8	193·0	+0·8	2·87	2·77	+0·10

Epoch.	Observer.	θ_o	θ_c	$\theta_o-\theta_c$	ρ_o	ρ_c	$\rho_o-\rho_c$
		°	°	°	″	″	″
1865·82	Dembowski	193·3	193·5	−0·2	2·59	2·75	−0·16
1867·40	O. Struve	196·1	195·3	+0·8	2·81	2·70	+0·11
1867·83	Dembowski	195·8	195·8	0·0	2·52	2·68	−0·16
1870·19	Dunér	198·6	198·8	−0·2	2·54	2·57	−0·03
1870·33	O. Struve	199·4	199·0	+0·4	2·79	2·57	+0·22
1870·35	Gledhill	200·5	199·0	+1·5	2·54	2·57	−0·03
1870·81	Dembowski	199·4	199·6	−0·2	2·43	2·55	−0·12
1871·35	Radcliffe	199·1	200·3	−1·2	2·43	2·53	−0·10
1871·38	Knott	199·2	200·3	−1·1	2·51	2·53	−0·02
1871·43	Pierce	199·9	200·4	−0·5	2·38	2·53	−0·15
1872·43	Dunér	201·7	201·7	0·0	2·67	2·49	+0·18
1872·89	Dembowski	201·9	202·3	−0·4	2·32	2·47	−0·15
1873·42	Linstedt	200·2	203·1	−2·9	2·41	2·45	−0·04
1873·57	Wilson & Seabroke	202·2	203·3	−1·1	2·45	2·44	+0·01
1874·79	Dembowski	205·2	205·1	+0·1	2·18	2·37	−0·19
1875·24	Dunér	206·4	205·8	+0·6	2·47	2·35	+0·12
1875·32	Schiaparelli	205 3	205·9	−0·6	2·34	2·34	0·00
1876·00	Wilson & Seabroke	207·6	206 9	+0·7	2·37	2·30	+0·07
1876·41	Plummer	208·6	207·5	+1·1	2·56	2·28	+0·28
1876·45	Schiaparelli	206·9	207·6	−0·7	2·15	2·28	−0·13
1876·85	Dembowski	208·5	208·2	+0·3	2·14	2·26	−0·12
1877·32	Doberck	208·4	209·1	−0·7	2·21	2·24	−0·03
1877·38	Schiaparelli	208·6	209·2	−0·6	2·25	2·24	+0·01
1878·34	Dembowski	210·5	210·9	−0·4	2·14	2·21	−0·07
1878·39	Seabroke	210·7	211·0	−0·3	2·55	2·21	+0·34
1879·42	Hall	214·5	212·8	+1·7	2·04	2·16	−0·12
1879·46	Schiaparelli	212·5	212·9	−0·4	2·20	2·16	+0·04
1879·50	Seabroke	214·0	213·0	+1·0	2·07	2·16	−0·09
1880·35	Hall	215·9	214·5	+1·4	1·92	(2·12)	−0·20
1880·37	Bigourdan	213·8	214·6	−0·8	2·13	2·11	+0·02
1880·46	Jedrzejewicz	215·4	214·7	+0·7	2·27	2·11	+0·16
1880·46	Seabroke	215·2	214·7	+0·5	2·03	2·11	−0·08
1881·33	Bigourdan	216·9	216·5	+0 4	1·98	2·05	−0·07
1881·36	Schiaparelli	217·9	216·6	+1·3	2·11	2·05	+0·06
1881·40	Hough	215·7	216·6	−0·9	1·96	2·05	−0·09
1881·40	Hall	217·8	216·6	+1·2	1·92	2·05	−0·13
1882·42	Hall	219·9	218·8	+1·1	1·93	2·00	−0·07
1882·44	Schiaparelli	220·0	218·9	+1·1	2·13	2·00	+0·13
1882·45	Seabroke	221·3	218·9	+2·4	2·22	2·00	+0·22

Epoch.	Observer.	θ_o	θ_c	$\theta_o-\theta_c$	ρ_o	ρ_c	$\rho_o-\rho_c$
		°	°	°	"	"	"
1882·46	Rugby	221·9	218·9	+3·0	2·22	2·00	+0·22
1882·93	Engelmann	221·2	219·9	+1·3	2·06	1·97	+0·09
1883·42	Hall	221·6	221·0	+0·6	1·90	1·94	−0·04
1883 46	Schiaparelli	221·8	221·1	+0·7	1·91	1·94	−0·03
1884·39	Hall	224·8	223·3	+1·5	1·86	1·89	−0·03
1884·46	Schiaparelli	224·9	223·5	+1·4	1·98	1·89	+0·09
1884 63	Rugby	226·6	223·9	+2·7	1·78	1·88	−0·10
1885·35	Perrotin	223·8	225·7	−1·9	1·86	1·84	+0·02
1885·36	Hall	226·8	225·7	+1·1	1·78	1·84	−0·06
1885·43	Rugby	227·9	225·9	+2·0	1·72	1·84	−0·12
1885·44	Schiaparelli	227·1	225·9	+1·2	1·83	1·84	−0·01
1886·38	Perrotin	228·7	228·4	+0·3	1·68	1·79	−0·11
1886·41	Rugby	231·4	228·5	+2·9	1·46	1·79	−0·33
1886·41	Hall	228 0	228·5	−0·5	1·83	1·79	+0·04
1887·37	Hall	232·7	231·3	+1·4	1·62	1·73	−0·11
1887·45	Schiaparelli	231·8	231·5	+0·3	1·67	1·73	−0·06
1887·45	Rugby	232·8	231·5	+1·3	1·08	1 73	−0·65
1887·59	Tarrant	228·0	231·9	−3·9	1·80	1·72	+0·08
1888·33	Rugby	236·5	234·1	+2·4	1·12	1·67	−0·55
1888·37	Hall	233·9	234·2	−0·3	1·61	1·67	−0·06
1889·28	Rugby	235·3	237·1	−1·8	1·60	1·61	−0·01
1889·45	Hall	237'1	237·7	−0 6	1·51	1·61	−0·10
1890·43	Hall	240·7	241·1	−0·4	1·54	1·54	0·00
1890·47	Hayn	240·5	241·2	−0·7	1·57	1·54	+0·03
1892·37	Burnham	248·6	248·6	0·0	1·46	1·43	+0·03

As the great majority of the residuals in position-angle are less than 2°, and many under 1°, the agreement may be considered satisfactory.

Assuming that the mass of the system is equal to the mass of the Sun, the "hypothetical parallax" will be—

$$p = aP^{-\frac{2}{3}} = 0''{\cdot}087.$$

On the Orbit of the Binary Star β 416. By J. E. Gore.

This star, which is identical with BAC 5825, was discovered as a wide double star by Sir John Herschel on 1837 June 8, during his residence at the Cape of Good Hope. In 1876 Mr. Burnham found the brighter component to be also double, but only estimated the position-angle and distance. Since its

discovery the star has not been often measured, there being no measures in the years 1877–88. I find, however, that the available measures, although few in number, are sufficient to give an approximate orbit, the change in position-angle since 1876 being over 200°. I have therefore computed the orbit, and find the following provisional elements:—

Elements of β 416.

P = 34·48 years	Ω = 139° 26′
T = 1891·85	λ = 278° 15′
e = 0·5562	a = 2″·13
i = 56° 43′·5	μ = −10°·4413

The following is a comparison between the measures and the positions computed from the above elements:—

Epoch.	Observer.	θ_o	θ_c	$\theta_o - \theta_c$	ρ_o	ρ	$\rho_o - \rho_c$
1876·52	Burnham	240° ±	231°·6	+8°·4	1″·80 ±	1″·81	−0″·01 ±
1877·53	At Cincinnati	222·6	225·1	−2·5	1·80	1·79	+0·01
1877·64	Russell	224·4	224·4	0·0	1·77	1·78	−0·01
1888·72	Burnham	147·5	146·8	+0·7	1·88	1·52	+0·36
1889·43	„	134·1	139·3	−5·2	1·35	1·36	−0·01
1889·63	Pollock	131·9	136·9	−5·0	0·97	1·30	−0·33
1891·53	Burnham	82·3	86·1	−3·8	0·51	0·60	−0·09
1892·38	„	24·4	24·3	+0·1	0·58	0·57	+0·01

The measure in 1892, made with the 36-inch refractor of the Lick Observatory, was kindly sent to me by Mr. Burnham.

Assuming the mass of the system to be equal to the mass of the Sun, the "hypothetical parallax" will be—

$$p = \frac{a}{P^{\frac{2}{3}}} = 0''\cdot201.$$

The magnitudes of the components are about 6·3, and 8. As a single star it was estimated 6·1 at Cordoba (142 Scorpii, U.A. =Lacaille 7215).

The position of the star is for 1880—

R.A. $17^h\ 10^m\ 47^s$

Decl. −34° 51′ 12″

Mr. Burnham measured the distant companion as follows:—

1892·36 : 129°·4 : 30″·55 ; mag. 12.

As Sir John Herschel estimated the position-angle at 130°±, there would seem to be no change in the position of this companion.

On certain Variable Stars having the Appearance, visually, of Planetary Nebulæ. By Cuthbert E. Peek, M.A.

Having observed variable stars regularly for the last seven years, I wish to call attention to a letter published in *Knowledge* 1892 March 1, in which I refer to the fact that a considerable number have, at times, the appearance of planetary nebulæ as described by Herr E. von Gothard in the January number of the *Monthly Notices*. Without repeating the whole of the facts there given, I quote the following with regard to three stars:—

R. Cassiopeiæ, 1886 September 17, 8·7 mag.—A large, ill-defined, deep-red star. 1889 March 11, 9·6 mag. Very hazy and ill-defined, as if shining through ruddy mist. Other stars sharp.

T. Cassiopeiæ, 1889 September 10, 7·7 mag.—Very red. A well-defined star shining through a ruddy haze.

S. Herculis, 1891 October 14.—With power 132 a faint nebulosity is suspected in the place of the variable; on slightly swaying the telescope a bluish nebulosity is certainly seen. It will be remembered that *Nova Aurigæ* was first described in the *Times* of 1892 February 3 as 'slightly fuzzy.' Instrument in use 6¼-inch equatoreal refractor.

Rousdon Observatory:
1892 *January* 29.

Observations of Saturn in 1892. By M. Joseph Guillaume, of the Observatoire de Lyon.

(*Communicated by the Rev. A. Freeman.*)

The following is the translation of a letter received by Mr. Freeman from M. Guillaume, 1893 January 5.

"I must first of all tell you that I left my own observatory at Péronnas (near Bourg-en-Bresse) in September last for that of Lyons, where I am working under the direction of M. Ch. André.

"I have published nothing as yet upon *Saturn* in 1892, but I proceed to give you all that I could say about the planet, leaving it to you to communicate it to the Royal Astronomical Society in part or entirely as may appear best to you.

"A long course of bad weather at the beginning of the year hindered me from observing as much as I could have desired, especially in watching the transits of the satellites other than

Titan, to which M. Terby has particularly drawn my attention. I have made only seventeen observations, which may be described thus :—

"The northern hemisphere continued to appear more dusky than the other. I noticed on it a broad bright band, which appeared striated on March 23. It was separated from a broader grey zone by a dusky narrow band sometimes stippled; and then, towards the north, another band of a deeper tint a little broader than the first band. These two bands were not always easy to limit internally. The polar cap has not always shown the same appearance; thus, when the details which I have mentioned were visible its aspect was less sombre; otherwise, although less deep in tint, there was never any sharp boundary between this region and the broad grey zone.

"On the south hemisphere the appearance was sensibly the same as in 1891. The equatorial band displayed brighter parts than the rest on March 11, and the rest of the hemisphere exhibited marblings; but on April 15, with a remarkably fine image, I saw the first dark band divided by a narrow bright line, very faint, and then two bright bands separated by a grey one of the same appearance as the polar cap.

"Apart from the variations of brightness remarked upon the two ansæ, there were few details to note upon the rings on account of their small opening. Sometimes the dark ring was perceived, and the Cassini division, always bordered externally by a bright zone similar to the ring *B*. On March 11 the ring *C* was visible, in front of the ball, at the same time with a narrow black line, which might be the shadow of the rings. *A* was grey at the ends of the ansæ. On March 31 the middle of *B* at the west was grey. Later, the ring closing up, I could only notice the difference of brightness, which I continued to register by schematic figures. On May 21, the last observation made, an interval between the ball and the ring appeared to a slight extent on the east. The western ansa [*eastern* is meant], after the opposition, appeared to me thinner against the ball than on the opposite side, which was evidently due to the shadow projected by the planet. On April 15 it even appeared separated from the ball with a magnifying power of 194, but with 298 there was no solution of continuity; the ring was only thinner.

"The shadow of the ring has sometimes been noticed oppositely curved relatively to the ring; it has exhibited variations of extent, produced by the differing inclinations of the Sun and the Earth to the plane of the rings.

"*The Satellites.*—I observed the shadow of *Titan* upon the ball on February 24; the satellite was dusky and greenish-yellow rather than orange-rose, as it appeared to me on 1891 December 23; it was very near the planet on the east; it must have passed in front very near the limb, but the clouds prevented me from following it. On March 11 an observation, short on account of the clouds, permitted me to see *Titan* and his shadow

near each other; the satellite was a little more south than the shadow, and very dark, almost black. On April 28 the clouds prevented me from seeing the passage before the ball, but a little later *Titan* travelled a very short distance to the south of the ring. I regretted having been unable to follow the transit, because *Titan* must have passed along the shadow of the ring. *Titan* appeared to me bluish-green, and of brightness sensibly equal to that of the ring. On May 6, from $8^h\ 10^m$ to $8^h\ 20^m$ [Paris M.T.], *Titan* was not visible; if it did not travel just behind the ring, which the state of the telescopic image prevented me from seeing, it was occulted. On May 14 I at first noticed this satellite in front of the ring as a luminous spot; then, towards the end of its passage, the instant of separation from the ring was not easy to determine precisely. At the beginning of the observation I believed I saw an indentation on the south border of the east ansa, which might be the shadow of *Titan*, but the view was not perfect enough for me to be absolutely sure of this appearance, which was of short duration.

"I several times attempted to observe the passage of the other satellites. Unfortunately the atmospheric conditions always left much to be desired, and my efforts to observe anything have met with no success. On April 15 the view, however, was such *at instants* that I do not think it possible to have a better; yet, in spite of all my attention, I was not able to observe the transit of *Rhea*; and, at the moment, I concluded that the phenomena of this satellite, and, for the greater reason, of the smaller satellites, could not be observed except with an instrument more powerful than my excellent reflector of 216 millimetres diameter ($8\frac{1}{2}$ ins.), the mirror by With."

Observations of the Position-Angle of the Ring of Saturn.
By A. Stanley Williams.

The following measures of the position-angle of the major axis of the ring of *Saturn* were made with a $6\frac{1}{2}$-inch reflector by Calver. The position micrometer is a small one by Troughton & Simms. The position circle, $2\frac{1}{2}$ inches in diameter, is divided to $30'$, and reads by a single vernier to $1'$. The magnifying power used was 230. Prior to April 22 a single thin wire was employed, but, owing to the increasing narrowness of the ring, this became unsatisfactory, and the subsequent measures were made by separating the distance-webs to a distance of about $4''$, and bringing the ring between them.

Date.	G.M.T.	Observed. p	Marth. p	Δp
1891.	h m	°	°	°
Dec. 20	16 57	85·75 (8)	85·99	+0·24
21	15 53	86·03 (5)	85·99	−0·04
22	16 38	85·80 (6)	85·99	+0·19
1892.				
Jan. 1	14 47	86·05 (6)	86·02	−0·03
4	16 5	85·70 (8)	86 02	+0·32
Mar. 18	10 23	85·52 (6)	85·72	+0·20
Apr. 1	9 55	85·26 (8)	85·63	+0·37
4	9 52	85·47 (8)	85·61	+0·14
17	12 28	85·50 (8)	85·54	+0·04
22	9 48	85·75 (8)	85·52	−0·23
23	9 54	85·50 (5)	85·51	+0·01
May 6	11 9	85·67 (8)	85·46	−0·21
8	9 45	85·74 (8)	85·46	−0·28
30	9 48	84·99 (12)	85·44	+0·45
June 6	9 37	85·34 (8)	85·44	+0·10
7	9 31	85·67 (8)	85·45	−0·22
			Mean =	+0·07

The figures in brackets after the observed position-angles indicate the number of settings. In the fourth column are given the position-angles of the axis of *Saturn* according to Mr. Marth's "Ephemerides of the Satellites of *Saturn*, 1891–1892," less 270°. In other words, they are the position-angles of the major axis of the narrow apparent ellipse formed by the planet's equator; and, assuming the plane of the ring to coincide with the plane of the equator, they would likewise be the computed position-angles of the major axis of the ring.

The mean value of the residuals Δp is $+3'\cdot96$, with a probable error of $\pm 2'\cdot29$; the probable error of a single observation being $\pm 9'\cdot12$. The telescope is equatorially mounted, but without clockwork. The major axis of the ring was, however, so little inclined to a parallel of declination, that the latter deficiency has probably had little or no effect on the accuracy of the measures. At any rate, judging from the above values of the probable errors, these observations appear comparable in point of accuracy with those made by other observers.

Brighton:
1893 *February* 24.

Observations of Mars and ι Aquarii near their conjunction on 1892 November 4. By John Tebbutt.

The actual conjunction of *Mars* and *ι Aquarii* occurred rather too early for observation in this meridian, but it was quite obvious that an occultation could not have taken place. The star is No. 163 of Herr Berberich's list in No. 3,073 of the *Astronomische Nachrichten*. Two sets of ten fairly good comparisons were obtained of the planet and star with the filar micrometer of the 8-inch equatoreal. In all twenty comparisons the planet's preceding limb was observed for right ascension, but in the first set the north and in the second the south limb was observed for declination. The following are the results, the corrections for chronometer rate and refraction being insensible. The star's mean place is derived from the Greenwich Catalogues for 1872 and 1880, the result from each catalogue being weighted according to the number of individual observations on which it is founded.

	First Set. h m s	Second Set. h m s
Windsor mean time of transit of Planet's limb	8 1 57·1	8 15 45·6
Star's adopted mean R.A. for 1892·0	22 0 36·21	22 0 36·21
Reduction	+2·46	+2·46
Observed Diff. R.A. of Limb and Star ...	+7·90	+8·97
Correction for Semidiameter	+0·50	+0·50
Correction for Parallax	+0·16	+0·20
Resulting Geocentric R.A. of Planet's centre ...	22 0 47·23	22 0 48·34
Geocentric R.A. of Centre from *Nautical Almanac*	22 0 47·23	22 0 48·41
Observation—*Nautical Almanac*	0·00	−0·07

	° ′ ″	° ′ ″
Star's adopted Mean Declination for 1892·0	−14 23 35·9	−14 23 35·9
Reduction	+8·2	+8·2
Observed Diff. Declination of Limb and Star ...	−1·1	−5·7
Correction for Semidiameter	−7·2	+7·2
Correction for Parallax	−3·8	−3·8
Resulting Geocentric Declination of Planet's centre	−14 23 39·8	−14 23 30·0
Geocentric Declination of Centre from *Nautical Almanac*	−14 23 38·7	−14 23 30·7
Observation—*Nautical Almanac*	−1·1	+0

The Occultation of Jupiter, 1893 *February* 20.
By C. Leeson Prince.

The weather was most unfavourable for observing this phenomenon, but through breaks in the clouds I was able to watch the gradual approach of the Moon towards the planet. Observation of first contact was prevented by a large mass of cloud, and when this cleared off the planet was very nearly occulted; but I was able to see the final disappearance, which happened at $0^h\ 33^m\ 31^s$, L.S.T., but upwards of 14 minutes later than the time given in the *Nautical Almanac*. The atmosphere was in a too tremulous condition to observe whether there was any distortion of the planet's limb or any shaded line upon it.

I had no further opportunity for observation until $1^h\ 45^m\ 15^s$, when the following limb of the planet was $8^m\ 30^s$ west of the Moon. I consider my new observatory to be 39 seconds east of Greenwich. Telescope is of 6·8 inches' aperture and 12-feet focal length. Power 80.

The Observatory, Crowborough, Sussex:
1893 *February*.

Observations of Brooks' Comet (g 1892) and Holmes' Comet (f 1892) made at the Royal Observatory, Greenwich.

(*Communicated by the Astronomer Royal.*)

The observations were made with the East, or Sheepshanks, Equatorial, aperture 6·7 inches, by taking transits over two cross wires at right angles to one another, and each inclined 45° to the parallel of declination. Transits were sometimes taken also over a third wire bisecting the angle between the two other wires. Magnifying power, 55.

Brooks' Comet.

Greenwich Mean Solar Time.					Observer.	☄−★ R.A.	Corr. for Refraction.	Corr. for Motion of ☄	Log. factor of Parallax.	☄−★ N.P.D.	Corr. for Refraction.	Corr. for Motion of ☄	Log. factor of Parallax.	No. of Comps.	Apparent R.A.	Apparent N.P.D.	Comp. Star.
1893.	d	h	m	s		m s	s	s		′ ″	″	″			h m s	° ′ ″	
Jan.	10	8	36	30	H.	−2 14·00	+0·04	−0·45	9·8843	+15 51·6	+0·3	−5·7	0·6373	3	20 59 37·02	27 18 36·4	*a*
	10	9	1	34	,,	−0 12 98	+0·01	−0·51	9·8742	+4 32·3	+0·1	−6·4	0·6921	2	21 0 0·06	27 19 43·6	*b*
	15	7	44	7	,,	+1 21·55	+0·03	−0·31	9·7958	+12 46·1	0·0	−2·5	0·4529	3	22 20 24·35	34 47 21·5	*c*
	15	8	20	34	,,	−0 53·30	0·00	+0·17	9·8080	− 2 24·5	−0·1	+1·3	0·5537	2	22 20 43·58	34 49 23·1	*d*
	20	10	6	19	A. C.	−0 6·43	−0·01	−0·09	9·7212	+ 8 26·8	+0·2	−0·6	0·7596	2	...	...	*e*
	20	10	15	45	,,	−0 12·03	+0·01	+0·11	9·7154	− 5 47·7	−0·2	+0·9	0·7720	4	...	...	*f*
Feb.	4	6	51	21	,,	+0 4·10	0·00	+0·06	9·5697	− 3 27·6	0·0	+0·5	0·6185	2	0 1 10·24	56 52 58·8	*g*
	4	6	55	37	B.	+0 3·03	0·00	+0·06	9·5750	− 3 39·4	0·0	+0·5	0·6237	3	0 1 9·17	56 52 47·0	*g*
	5	6	45	16	,,	−1 3·70	0·00	+0·03	9·5625	+ 0 20·3	0·0	+0·3	0·6213	2	...	...	*h*
	5	6	52	4	A. C.	−1 2·03	0·00	+0·03	9·5700	+ 0 30·0	0·0	+0·3	0·6284	4	...	...	*h*
	5	6	55	0	,,	−1 35·66	0·00	+0·03	9·5732	+ 5 15·0	0·0	+0·3	0·6315	1	...	...	*i*
	8	6	51	42	B.	−0 6·18	0·00	−0·03	9·5678	+ 2 12·0	0·0	−0·3	0·6544	3	0 9 26·58	59 22 1·4	*j*
	10	7	13	45	,,	+0 55·09	0·00	−0·03	9·5925	+ 0 34·4	0·0	−0·3	0·6869	2	...	...	*k*
	16	6	41	23	,,	−0 27·56	0·00	+0·02	9·5603	− 6 26·5	−0·1	+0·2	0·6966	3	...	...	*l*

Holmes' Comet.

Greenwich Mean Solar Time.				Observer.	☄ − ✶ R.A.	Corr. for Refraction.	Corr. for Motion of ☄	Log. factor of Parallax.	☄ − ✶ N.P.D.	Corr. for Refraction.	Corr. for Motion of ☄	Log. factor of Parallax.	No. of Comps.	Apparent R.A.	Apparent N.P.D.	Comp. Star.
1893.	d	h m	s		m s	s	s		′ ″	″	″			h m s	° ′ ″	
Jan.	20	9 27	41	A. C.	+2 14·93	0·00	0·00	9·5834	− 1 25·9	0·0	0·0	0·6268	2	1 27 1·98	56 21 7·7	*m*
	24	9 24	19	„	+0 2·93	0·00	0·00	9·5931	+ 7 55·9	0·0	0·0	0·6348	3	1 32 33·74	56 19 33·5	*n*
	27	6 19	29	L.	+0 29·42	0·00	0·00	9·1330	+ 0 27·5	0·0	−0·2	0·4494	2	...	...	*o*
	27	6 28	27	A. C.	+0 30·08	0·00	0·00	9·1853	+ 0 27·2	0·0	0·0	0·4557	2	...	...	*o*
	27	6 33	2	B.	+0 28·64	0·00	0·00	9·2077	+ 0 39·0	0·0	0·0	0·4590	2	...	...	*o*
Feb.	4	7 9	34	„	+0 58·91	0·00	0·00	9·4108	+ 6 12·4	0·0	−0·2	0·5075	3	1 48 25·93	56 7 49·9	*p*
	4	8 36	20	A. C.	+1 8·39	0·00	0·00	9·5716	+ 6 38·4	+0·1	−0·3	0·6084	4	1 48 35·41	56 8 15·9	*p*
	5	8 34	13	B.	−0 12·40	0·00	0·00	9·5718	− 1 31·3	0·0	+0·3	0·6080	3	...	...	*q*
	5	8 49	7	„	+2 36·89	0·00	0·00	9·5888	+ 4 51·6	0·0	−0·2	0·6262	2	1 50 3·89	56 6 29·1	*p*
	5	9 42	12	A. C.	−2 33·20	0·00	0·00	9·6303	− 3 24·3	0·0	+0·2	0·6890	2	1 50 10·21	56 7 18·9	*r*
	6	6 42	56	B.	−1 16·31	0·00	0·00	9·3460	− 5 48·4	0·0	+0·2	0·4846	2	1 51 27·08	56 4 54·8	*r*
	6	7 14	24	T. H.	−1 12·45	0·00	0·00	9·4342	− 5 42·0	0·0	+0·3	0·5168	4	1 51 30·94	56 5 1·3	*r*
	7	8 12	19	H.	+0 24·96	0·00	0·00	9·5348	− 7 27·0	−0·1	+0·3	0·5870	5	1 53 8·34	56 3 16·4	*r*

Greenwich Mean Solar Time.					Observer.	ΔA.	Corr. for Refraction.	Corr. for Motion of ✱	Log. factor of Parallax.	✱−✱ N.P.D.	Corr. for Refraction.	Corr. for Motion of ✱	Log. factor of Parallax.	No. of Comps.	Apparent R.A.	Apparent N.P.D.	Comp. Star.
1893.	d	h	m	s		m s	s	s		′ ″	″	″			h m s	° ′ ″	
Feb.	8	7	6	17	B.	−0 31·59	0·00	0·00	9·4275	+ 2 56·6	0·0	0·0	0·5125	3	...	...	*s*
	8	7	24	9	,,	+1 53·40	0·00	0·00	9·4684	− 9 30·2	0·0	+0·3	0·5319	3	1 54 36·76	56 1 13·4	*r*
	10	7	34	59	,,	+0 11·24	0·00	0·00	9·5003	+ 0 1·5	0·0	+0·3	0·5492	3	...	...	*t*
	10	7	41	29	,,	+1 17·80	0·00	0·00	9·5127	+ 7 7·6	+0·1	−0·2	0·5572	2	1 57 44·26	55 58 17·0	*u*
	14	8	47	14	T. H.	+0 40·20	0·00	0·00	9·6082	+ 9 18·8	0·0	−0·4	0·6462	1	...	...	*v*
	15	9	45	32	H.	−1 11·73	0·00	0·00	9·6430	− 4 24·7	−0·1	−0·2	0·7173	2	...	...	*w*
	15	9	50	59	,,	−1 48·60	0·00	0·00	9·6440	− 4 4·2	−0·1	0·0	0·7233	5	2 5 51·75	55 48 31·7	*x*
	15	10	3	44	,,	−1 43·35	+0·01	0·00	9·6471	− 9 53·9	−0·3	+0·4	0·7375	2	2 5 52·47	55 49 5·8	*y*
	16	6	59	23	B.	−0 23·93	0·00	0·00	9·4567	− 6 17·2	0·0	+0·2	0·5206	3	2 7 16·40	55 46 19·1	*x*
	16	7	5	18	,,	−0 43·27	0·00	0·00	9·4699	+11 3·0	0·0	−0·4	0·5277	3	...	...	*z*

Notes.

The observations are corrected for refraction but not for parallax. They are also corrected for the error of inclination of the wires, and where necessary for the motion of the comets in R.A. and N.P.D.

On January 15 Brooks' Comet was very faint; no nucleus seen. On February 10 it was exceedingly faint and difficult to observe.

On January 20 Holmes' Comet was small and very bright, but it rapidly became fainter and more diffused.

Comparison Stars.

	Star's Name.	R.A., 1893·0. h m s	N.P.D., 1893·0. ° ′ ″	Authority.
a	B.D. + 62°, 1889	21 1 54·94	27 2 49·7	Astr. Gesell. Cat. (Helsingfors-Gotha, 1875)
b	B.D + 62°, 1885	21 0 17·03	27 15 17·0	,, ,, ,,
c	Piazzi XXII., 92	22 19 5·79	34 34 41·3	Greenwich Observations, 1890.
d	B.D. + 54°, 2773	22 21 39·39	34 51 50·0	Astr. Gesell. Cat. (Helsingfors-Gotha, 1875)
e	B.D. + 47°, 4061	23 5 2	42 11	Equatorial comparisons with neighbouring stars.
f	B.D. + 47°, 4060	23 5 12	42 26	Bonn Observations, vol. v.
g	W.B. (2) XXIII., 1306	0 1 7·66	56 56 27·6	Paris Observations in 1862 and 1881.
h	Anonymous	0 4 14	57 28	Difference from Star *i*.
i	B.D. + 32°, 10	0 4 48	57 23	Bonn Observations, vol. iv.
j	B.D. + 30°, 27	0 9 34·33	59 19 50·6	,, ,, vol. vi.
k	B.D. + 29°, 30	0 10 22	59 50	,, ,, vol. iv.
l	B.D. + 26°, 62	0 22 56	63 19	,, ,, ,,
m	Lalande, 2729	1 24 47·93	56 22 41·8	Paris Observations, 1881.
n	B.D. + 33°, 267	1 32 31·70	56 11 45·9	Bonn Observations, vol. vi.
o	B.D. + 33°, 282	1 36 9	56 16	,, ,, vol. iv.
p	W.B. (2) I, 1047	1 47 27·99	56 1 45·8	Weisse's Bessel
q	B.D. + 33°, 325	1 50 19	56 8	Bonn Observations, vol. iv.
r	Lalande, 3619	1 52 44·36	56 10 51·1	Paris Observations, 1880.

	Star's Name.	R.A., 1893·0. h m s	N.P.D., 1893·0. ° ′ ″	Authority.
s	B.D. + 33°, 339	1 55 5	55 59	Bonn Observations, vol. iv.
t	B.D. + 33°, 353	1 57 32	55 57	,, ,, ,,
u	W.B. (2) I., 1292	1 56 27·47	55 51 17·5	Weisse's Bessel.
v	B.D. + 34°, 382	2 3 32	55 41	Bonn Observations, vol. iv.
w	B.D. + 33°, 381	2 7 3	55 52	,, ,, ,,
x	Lalande, 4092	2 7 41·37	55 52 44·0	Paris Observations, 1882.
y	Lalande, 4086	2 7 36·83	55 59 7·6	,, ,, ,,
z	B.D. + 34°, 396	2 8 1	55 36	Bonn Observations, vol. iv.

Note.

The place of star *e* in the B.D. reduced to 1893·0 (viz., R.A. $23^h\ 5^m\ 26^s$, N.P.D. 42° 10′) appears to be largely in error. The place given is derived from approximate equatorial comparisons with neighbouring stars.

The initials L., H., A. C., B., T. H., are those of Mr. Lewis, Mr. Hollis, Mr. Crommelin, Mr. Bryant, and Mr. Hudson respectively.

Erratum in '*Monthly Notices*,' liii. 3 (1893 *January*), *pp.* 134, 135.

Star *d* (Lalande 25647), N.P.D., *for* 57° 33′ 55″·0 *read* 57° 35′ 55″·0.
Corresponding N.P.D. of ☄, *for* 57° 40′ 11″·3 *read* 57° 42′ 11″·3.

Errata.

In Mr. Gledhill's paper, *Monthly Notices*, vol. liii. pp. 149, 150, the *observed* times should read $8^h\ 55^m$, &c., instead of $8^h{\cdot}55$. The *predicted* times, however, being quoted from Mr. Marth's Ephemeris, are given in decimals of an hour.

In the obituary of Prof. J. C. Adams, *Monthly Notices*, vol. liii. p. 201,

1st line from top, *for* 39′ *read* 29′ ; and
2nd „ „ *for* 23·25 *read* 33·25 years.

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